

Trend of Value-added Assessment of Nudge Adolescent Mental Health from the Perspective of AI

Zhiwen Tang¹, Ying Lin^{2*}, Hailong Sun^{3*}, Rongjun Zhao¹, Fang Bian^{1*}

¹School of Management, University of Electronic Science and Technology of China, Zhongshan Institute, Zhongshan, 528402, Guangdong, China

²Guangdong Women's Polytechnic College, Guangzhou 511450, Guangdong, China

³School of Business, Guangdong University of Foreign Studies, Guangzhou, Guangdong, China

* Corresponding Authors.

Abstract:

Intelligent wearable devices, APP and mini programs of mobile phone are increasingly widely used, providing more objective and dynamic data for adolescent mental health monitoring. The development of artificial intelligence promotes the diversity of adolescent mental health evaluation and intervention. Because the factors affecting mental health of adolescents are complicated by individual personality traits, peer relationship and family, it is necessary to explore the relationship between different factors based on the viewpoint of value-added assessment, and to dig out the key intervention problems and influencing factors. From the perspective of artificial intelligence equipment and value-added assessment, a multi-level value-added assessment system of individual, family, school and community is constructed to form an organic value-added system of mental health so as to promote the mental health of adolescents individually.

Keywords: Artificial Intelligence, Adolescents, Mental health, Value-added assessment, Nudge.

I. INTRODUCTION

Under the background of digitalization development, the digitalization of adolescent mental health is beneficial to the improvement of mental health level. Adolescent behavior problems, psychological problems and suicide problems are obviously increasing, and mental health problems such as somatization, obsessive-compulsive symptoms, interpersonal sensitivity and depression, which were mainly occurred in adults in the past, begin to occur more and more frequently among adolescents and students. Statistics show that 24.39% of primary and middle school students in Shanghai had the idea of "ending their own life", 15.23% had seriously considered the idea, 5.85% had planned suicide, and 1.71% had attempted suicide. How to maintain the adolescent mental health has attracted extensive attention. The State also issued the *Healthy China Action-Action Plan for Adolescent Mental Health (2019-2022)*, which pointed out that "implement prevention and intervention measures for adolescent psychological behavior problems

and mental disorders, strengthen psychological counseling for key groups, lay an important foundation for improving adolescent health and well-being and jointly building and sharing health China", and promote the development of adolescent mental health through six actions including mental health education, environment construction, health promotion, health care, health service ability improvement and health service system improvement. In the reply to the CPPCC "*Proposal on Further Implementation of Measures for Prevention and Treatment of Adolescent Depression*", the Ministry of Education explicitly mentioned that "depression screening will be included in the physical examination of students, mental health archives shall be established, mental health status of students shall be assessed, and special attention shall be paid to students with abnormal assessment results." However, there is no instruction on how to form the management system and further study is needed. Without the establishment of mental health assessment system, the improvement of adolescent mental health will be a dead letter. With the development of artificial intelligence, the assessment methods of adolescent mental health will be more diversified, which provides a new way to improve adolescent mental health.

II. INFLUENCING FACTORS OF ADOLESCENT MENTAL HEALTH

From the perspective of mental health, there are the following factors affecting mental health.

First, the individual factor. The adolescent period is the key period in which various psychological and behavioral problems easily occur in the process of individual growth and development. The mental health level during this period affects one's lifelong development. Erickson points out that adolescents are in the conflict period of self-identity and confusion of roles, and individuals have certain understanding of themselves, which is an important period for the development of values. Otherwise, there will be some problematic behaviors caused by psychological problems such as drug abuse [1], alcoholism [2], overeating [3], adolescent emotional problems [4], suicide [5, 6] and so on.

Second, peer factor. Peer is one of the most important social relationships in adolescence. Because they are at the similar level in physiology and psychology, the both sides influence each other psychologically, imitate each other in behavior and identify with each other in concept, so as to internalize and integrate into their own psychological structure, and then affect the mental health development of adolescents. Therefore, good peer relationships contribute to social development [7] and vice versa, such as Internet addiction [8, 9]. It has been found that negative peer relationships can not provide help for junior high school students' development, even bring negative effects on their development, making them become depressed, lonely or rebellious [10]. Liu Wenping (2020) et al found that peer relationship is positively correlated to mental health level in transfer behavior, and positive peer relationship can alleviate students' psychological anxiety [11]. Shi Yan (2021) et al found that peer relationship has positive improvement effect on depression [12]. On the contrary, Klein et al (1995) found that a large number of anti-social behaviors among adolescents are mostly in the form of gangs. Adolescents with poor peer relationship may have difficulties in school adaptation, and may even show social maladjustment to a certain extent after their adult life.

Third, the family factor. The appropriateness of parents' education for their children plays a role in adolescent mental health. In his book *Unequal Childhood*, sociologist Annette Lareau points out that family upbringing refers to a series of related knowledge, strategies, habits and styles transmitted by parents to their children in order to help their children communicate with others and adapt to social environment, which is an approach to the physical transformation of cultural capital. Studies have found that parental support for adolescents will affect their mobile phone and Internet addiction [13, 14]. The field of psychology focuses on parents' parenting behavior and parenting attitude or concept. It is found that the intimate relationship between parents is significantly positively correlated with adolescent mental health [15]. Parents' behavior of treating adolescents fairly will affect the level of mental health [16]. Wang Mingzhong (2014) et al found that parental conflict may lead to adolescent depression and social anxiety. Later, Xiao Xue (2017) et al. also found that mother-child intimacy and mother-child conflict play a mediating role between parental conflict and adolescent depression. Later, Chang Fan (2020) et al found that adopting warm-understanding parenting style can reduce the risk of students' depression experience, and adopting severe punishment, excessive interference, over-protection or refusal to deny may increase the risk of depression [17]. Meanwhile, Yu Si (2021) et al investigated 845 students of the second grade from 8 middle schools in 7 provinces in China, and found that parental neglect had significant positive predictive effect on suicidal ideation [18], which is consistent with the study by Heat jer et al. [19].

III. APPLICATION TREND OF ARTIFICIAL INTELLIGENCE IN MENTAL HEALTH

With the development of artificial intelligence, mental health assessment and boost from the perspective of artificial intelligence have been increasingly adopted in the field of mental health. Machine learning [20] and natural language analysis (Stewart R, Velupillai S, 2020) are used to capture and analyze the information on social media such as Twitter and Facebook [21]. Since the time span of social media information is large, including psychological characteristics such as individual's emotional attitude, it plays a great role in analyzing individual depression and anxiety. Luo Fang (2021) et al. analyze the psychological characteristics of middle and primary school by online learning evaluation; the use of smart wearable devices plays a good role in collecting mental health indicators. With the continuous development of intelligent devices, smart wearable devices can monitor physical performance, physiological status, biochemical components, etc. and make evaluation on mental status [22]. For example, the development of portable wearable and non-intrusive devices such as EEG headphones and smart watches provides the possibility for monitoring mental health. Individual mental health status can be analyzed through collected ECG data, EEG data, emotion capture in face unlocking, telephone voice analysis system, etc. [23]. Xiao et al.(2022) extracted gait features from video to construct prediction model, and the prediction accuracy of emotion reached more than 92% [24].

Artificial intelligence also has many advantages in treatment, with Woebot, Wysa and Tess being the three most famous therapeutic mental health chat robots that have emerged over the past few years. Woebot provides cognitive behavioral therapy follow-up in the form of short daily conversations and emotions to help alleviate depression and anxiety disorders [23]. After using Woebot for two weeks, depression was significantly reduced and anxiety as measured by the Generalized Anxiety Disorder Scale

(GAD-7) was significantly reduced. The Wysa system includes cognitive behavioral therapy, behavioral reinforcement, and mindfulness to help reduce depression. Tess's feasibility study found that there was a statistically significant difference between depression and anxiety among college students after chatting with Tess.

IV. PROBLEMS IN CURRENT ADOLESCENT MENTAL HEALTH EDUCATION

Firstly, we can find that the development of adolescent mental health and individual, companion, family and society have important influence. At present, various measures have been taken for adolescent mental health, but most of these measures are based on late intervention. How to avoid or even strengthen adolescent mental health level and how to make teenagers better understand psychological problems, adjust psychological problems and get help is a serial engineering, which needs individual, family, school and community to build an ecological system.

Secondly, the school has set up parent school, whose educational content is often random, without directionality and systematization; the form of education is too simple, all kinds of gratitude education with tears, all kinds of special lectures that are very excited and have no actions; the lack of school psychology curriculum does not accord with the needs of students. In the assessment, it is found that the utilization rate of school mental health is low; the construction of psychological counseling rooms in many schools is worrying with insufficient equipment and space. In terms of software condition, teachers' allocation and specialization. School teachers in the central urban area are fully equipped, but psychological teachers often teach other subjects, and even some schools mix moral education, moral education and mental health education. In the third and fourth cities, teachers are not well equipped, which makes it difficult to recruit teachers in mental health.

Thirdly, in the aspect of specialization, many teachers often work with certificates after studying mental health lectures for a few days, and the basic psychological consultation procedures are not clear. At present, the mental health teachers in schools are insufficient, and they are unable to undertake the mental health boosting work of teenagers after completing the basic teaching work. It is difficult to solve the problem of mental health because of the unbalanced economic development in different areas, different social pressure and academic pressure, different school conditions, different levels of teachers and parents.

At last, the systematization of mental health education is insufficient, although they are dealing with mental health problems, but there is no systematic integration theory. With the support of big data, it is necessary to digitize adolescent mental health problems. Therefore, accurate prediction and trend analysis can be made through digitalization based on digital evaluation of different individuals.

V. VALUE-ADDED ASSESSMENT AND ARTIFICIAL INTELLIGENCE BOOST MENTAL HEALTH

The above-mentioned problems can be solved from the perspective of AI mental health system and value-added assessment. Value-added assessment originated from the concept of "value-added" in economics. Value-added assessment requires to consider the amount of "input" when evaluating "output", reduce cost, improve income and pursue maximum value-added. Value-added assessment is based on the value-added of students' expected achievement by school education activities, which is used to judge the positive influence of teachers and schools on students' growth. Value-added evaluation method is more used to judge the mental health progress of students, which is a developmental evaluation. The key of value-added assessment is to pay attention to the aspect of growth, explore the core point of students' mental health education, excavate the core factors from different levels such as teachers, families, schools and so on, and then put forward targeted strategies to boost students' mental health, identify the core issues, invest the least intervention resources, and improve the mental health level of school.

Mental health is a key value-added point for adolescents to add value. The basic meaning of value-added is value increase. The value-added assessment of mental health is to judge the increment of mental health value. The exact analysis of value-added can not be separated from digital guidance. Through collecting and analyzing big data of artificial intelligence equipment, the effect and way of individual value-added of mental health can be explored more accurately. However, because artificial intelligence technology has a certain replication, in the past application also based on individual analysis, the construction of systematic monitoring and intervention mechanism has not yet formed, so we can rely on artificial intelligence and other digital means, through accurate data analysis to explore the key points of value-added assessment, to help mental health education.

The mental health system based on the concept of value-added assessment focuses on data. The digital technology is adopted to establish the evaluation system, and the mode of collecting big data is used to analyze the mental health status of students. Through APP, language analysis system in mini program, mental health investigation system and intelligent wearable system, the objective information of adolescent's behavior in life and learning can be collected continuously. The data uploads can be adolescents themselves, teachers and parents, so as to generate rich data sets, thus the students' mental health status and appreciation opportunity can be found out. By building an early warning data model, students' mental health status can be tracked, and remote mental health promotion can be carried out through APP.

Therefore, based on the value-added assessment system of adolescent mental health in the view of artificial intelligence, a multi-level value-added assessment system of individual, family, school and community is constructed mathematically to form an organism. The value-added assessment system of mental health, through collecting and analyzing the mental health data of adolescents, constructs a solution integrating individual, family, school and society. Different individuals, families, schools, and social

variables have different outcomes. Formulate systematic analysis is needed to develop systematic solutions.

ACKNOWLEDGEMENTS

This work was supported by Guangdong Province Philosophy and Social Science Planning 2020 Project (Grant No.GD20XJY25); Guangdong Education Science 2021 Education Science Planning Project (Grant No. 2021GXJK287); Guangdong Social Science Planning 2021 Project (Grant No. GD21CJY12). Sponsored by Guangdong Higher School Ideological and Political Education Research Association (Grant No.SCNUKFZC050).

REFERENCES

- [1] Paul Anthea B. Mahesan, Simms Lary, Mahesan Andrew A. (2018) Belanger Eric Charles. Teens, Drugs, & Vegas: Toxicological surveillance of illicit prescription and illegal drug abuse in adolescents (12–17 years) using post-mortem data in Clark County, Nevada from 2005 to 2015. *Journal of Forensic and Legal Medicine*. 58:20-24.
- [2] Cousijn Janna, Kenemans J. Leon, Vanderschuren Louk J. M. J., Lesscher Heidi M. B. (2019) Unravelling the Adolescent Paradox of Risk and Resilience to Alcohol Addiction: A Translational Perspective. *Biological Psychiatry*, 85 (10, Supplement):S86.
- [3] Skinner Janelle, Jebeile Hiba, Burrows Tracy. (2021) Food addiction and mental health in adolescents: a systematic review. *The Lancet Child & Adolescent Health*. 5(10):751-766.
- [4] Ankita Mishra Aura, Kristine Marceau, Christ Sharon L., M Schwab Reese Laura, E. Taylor Zoe, S Knopik Valerie. (2022) Multi-type childhood maltreatment exposure and substance use development from adolescence to early adulthood: A GxE study. *Child Abuse & Neglect*.126.
- [5] da Silva Uanderson Pereira, Reis Alberto Olavo Advincula, Pereira Yara Talita Gomes, Vieira Nélio Barreto, Neto Modesto Leite Rolim, Lima Nádia Nara Rolim . (2021) Cemetery, tombstones, tears and hidden silences: Suicide in children and adolescents. *Journal of Pediatric Nursing* (3).
- [6] Falcone T., Dagar A., Castilla-Puentes R. C., Anand A., Brethenoux C., Valleta L. G. (2020) Digital conversations about suicide among teenagers and adults with epilepsy: A big-data, machine learning analysis. *Epilepsia*. 61(5):951-958.
- [7] Wei Wendy S., McCoy Dana C., Hanno Emily C. (2021) Classroom-level peer self-regulation as a predictor of individual self-regulatory and social-emotional development in Brazil. *Journal of Applied Developmental Psychology*. 77:101347.
- [8] Lozano-BlascoM Raquel, Latorre-Martínez Pilar, Cortés-Pascual Alejandra. (2022) Screen addicts: A meta-analysis of internet addiction in adolescence. *Children and Youth Services Review*. 135.
- [9] Chi Xinli, Hong Xin, Chen Xiaochen. (2020) Profiles and sociodemographic correlates of Internet addiction in early adolescents in southern China. *Addictive Behaviors*. 106:106385.
- [10] Xiong Xiaoni. (2021) Relationship between Parental Culture Adherence and Self-identity of Senior High School Students: Multiple Mediating Effects of Self-esteem and Peer Relationship 2019.
- [11] Liu Wenping, Yang Fan. (2021) Research on Influence Mechanism of Transferred Students' Mental Health Level_Empirical Evidence from China Education Follow-up Survey (CEPS), *Shanghai Research on Education*. 2: 25-30.
- [12] Shi Yan, Ni Yuanyuan, Ji Xuan, Luo Hong, Ping Weiwei. (2021) Influence of Empathy Ability on Depression of

- Clinical Medical Students: Chain Mediator of Peer Relationship Satisfaction and Psychological Elasticity. *China Journal of Health Psychology*. 26(2): 305-309.
- [13] Lei Hao, Li Shunyu. (2018) Social support and Internet addiction among mainland Chinese teenagers and young adults: A meta-analysis. *Computers in Human Behavior*.85(4):200-209.
- [14] Chou Hui-Lien, Chou Chien. (2019) A quantitative analysis of factors related to Taiwan teenagers' smartphone addiction tendency using a random sample of parent-child dyads. *Computers in Human Behavior*. 99(5):335-344.
- [15] Chen Xueming, Liu Tour, Luo Jie, Ren Shixiu. (2020) Data for teenagers' stressor, mental health, coping style, social support, parenting style and self-efficacy in South China. *Data in Brief*. 29:105202.
- [16] Fernandez-Kranz Daniel, Nollenberger Natalia. (2022) The impact of equal parenting time laws on family outcomes and risky behavior by teenagers: Evidence from Spain. *Journal of Economic Behavior & Organization*. 195(2):303-325.
- [17] Chang Fan, Li Wei, Zhang Jing, Su Meng. (2020) Relationship between Parental Rearing Style of Medical Students and Depression .*China Journal of Health Psychology*. 28(2): 231-234.
- [18] Lin Yue, Liu Qinxue, Yu Si, Zhou Zongkui. (2021)Relationship between Parents' Neglect and Adolescent Online Game Addiction: Intermediary Function of Hope and Regulation of Gender. *Psychological Development and Education*. 37(1): 109-119.
- [19] Turner Heather A., Colburn Deirdre. (2022) Independent and Cumulative Effects of Recent Maltreatment on Suicidal Ideation and Thoughts of Self-harm in a National Sample of Youth. *Journal of Adolescent Health*. 70(2):329-335.
- [20] Anmella G., Hidalgo-Mazzei D., Faurhoilt-Jepsen M., Passos I., Ballester P., Kapczinski F. (2021) P.0092 The efficacy of smartphone-based interventions in bipolar disorder: systematic-review and meta-analyses. A position paper from the ISBD Big Data Task-Force. *European Neuropsychopharmacology*. 53:65-66.
- [21] Velupillai Sumithra, Suominen Hanna, Liakata Maria, Roberts Angus, Shah Anoop D., Morley Katherine, et al. (2018) Using clinical Natural Language Processing for health outcomes research: Overview and actionable suggestions for future advances. *Journal of Biomedical Informatics*. 88:11-19.
- [22] Li Xinwen, Sun Li, Rochester Christine A. (2021) Embedded system and smart embedded wearable devices promote youth sports health. *Microprocessors and Microsystems*. 83:104019.
- [23] D'Alfonso Simon. (2020) AI in mental health. *Current Opinion in Psychology*. 36:112-117.
- [24] Sun Xiao, Su Kai, Fan Chunxiao. (2022) VFL—A deep learning-based framework for classifying walking gaits into emotions. *Neurocomputing*. 473:1-13.